

Title: Evidence for Transfer of Tylosin and Tylosin-Resistant Bacteria in Air from Swine Production Facilities using Sub-Therapeutic Concentrations of Tylan in Feed

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Technical Abstract:

Macrolides are an important class of antibiotics used in human and veterinary medicine for therapy and prevention of diseases caused by Gram-positive bacteria, and as animal growth promotants. Tylosin belongs to the class of 16-membered macrolide antibiotics, and has been used exclusively in veterinary medicine for treatment of animal diseases or for enhancing animal growth rate. Antibiotic resistance studies have recently focused on measuring tylosin residues and tylosin-resistant bacteria (TRB) in animal products or in effluent streams from animal production facilities as potential routes for transfer of antibiotic resistance to humans. However, these studies have not considered aerial transfer from point sources as a significant route in human exposure. This study quantified the concentration of tylosin and TRB in air from three mechanically ventilated swine (finisher stage) confinements using tylosin at sub-therapeutic concentrations (20 g/ton) in feed. Tylosin residues and culturable bacteria in air at exhaust fans were trapped on absorbent resins or impinger samplers, respectively. Tylosin concentration was determined by high-performance liquid chromatography-electrospray tandem (MS-MS) mass spectrometry following solvent desorption of absorbent resins. The number of culturable bacteria and culturable, TRB were determined by plating on standard plate count agar containing no tylosin or 50 $\mu\text{g}\cdot\text{ml}^{-1}$ tylosin, respectively. The mean concentration of TRB ($49,400 \pm 16,700 \text{ CFU}\cdot\text{m}^{-3}$) accounted for approximately 80% of the total culturable bacteria ($62,100 \pm 18,300 \text{ CFU}\cdot\text{m}^{-3}$) present in air streams from confinements, with *Corynebacterium* the predominant genus of TRB. The mean concentration of tylosin in the air from the three confinements was shown to be $8.1 \pm 5.3 \text{ ng}\cdot\text{L}^{-1}$ of exhaust air. Feeder operation, ventilation rate, and animal activity were shown to be the most significant variables influencing emission rate of tylosin and culturable TRB from the swine confinements. The results indicate that aerial transfer of antibiotics and antibiotic-resistant bacteria from swine confinements may represent an important, and previously overlooked mechanism for transfer of antibiotic resistance to humans and to the environment.